

1 ADAPTER FOR USE WITH A TANDEM-FREE CONFERENCE BRIDGE

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3

4 **FIELD OF THE INVENTION**

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6 The present invention relates in general to
7 teleconferencing systems and, more particularly, to an
8 adapter for use with a conference bridge that is capable of
9 operating on compressed speech packets.

10

11 **BACKGROUND OF THE INVENTION**

12

13 In the interest of bandwidth economy, technologies have
14 been developed to enable the transmission of compressed
15 speech between media gateways in a network. Specifically,
16 upon receipt of a speech signal from an end user, a media
17 gateway encodes (or "compresses") the speech and sends the
18 compressed speech to a remote media gateway in the network
19 in the form of a compressed speech packet. At the remote
20 gateway, the compressed speech is decoded (or
21 "decompressed") into a speech signal and sent to an end
22 user telephony device over a communication link, typically
23 in a pulse coded modulation (PCM) format. The transmission
24 of compressed speech between media gateways results in
25 bandwidth economy.

26

27 In order to provide conferencing functionality, it is
28 possible to introduce a device known as a "conference
29 bridge" into the above scenario. However, a conventional
30 conference bridge operates on decompressed speech signals,
31 which leads to various disadvantages. Specifically, the
32 introduction of a conventional conference bridge between
33 media gateways requires an extra decompression stage at

1 each input to the conference bridge followed by an extra
2 stage of compression at each output of the conferencing
3 bridge. This is known as "tandem" operation of speech
4 codecs caused by the use of a conventional conference
5 bridge. The "tandem" operation of speech codecs described
6 above induces a loss of perceived signal quality, as well
7 as an increase in required processing power.

8
9 Therefore, as an improvement, the concept of a "tandem-
10 free" conference bridge has been introduced. As described
11 in, for example, published United States Patent Application
12 Serial No. 09/986,498 to Rabipour et al., filed on November
13 9, 2001, published on August 8, 2002, hereby incorporated
14 by reference herein, and the references cited therein, the
15 tandem-free conference bridge makes forwarding decisions on
16 the basis of "auxiliary information" received together with
17 compressed speech for each media stream. Because of the
18 presence of auxiliary information, the tandem-free bridge
19 need not actually decode the compressed speech, hence
20 resulting in an improvement in end-to-end speech quality.

21
22 The reader may also find it useful to consult other
23 references that describe tandem-free bridge capabilities,
24 including U.S. Patent Application Serial No. 09/475,047
25 entitled "Apparatus and Method for Packet-Based Media
26 Communications" filed on December 30, 1999; U.S. Patent
27 Application Serial No. 09/750,015 entitled "Apparatus and
28 Method for Packet-Based Media Communications" filed on
29 December 29, 2000, published on July 4, 2002; and U.S.
30 Patent Application Serial No. 09/664,450 entitled
31 "Apparatus and Method for Packet-Based Media
32 Communications" filed on September 18, 2000. The contents

1 of each of these references is incorporated by reference
2 herein.

3

4 However, conventional media gateways do not possess the
5 additional ability to provide the auxiliary information
6 expected by the tandem-free conference bridge, nor the
7 additional ability to process the auxiliary information
8 received from the tandem-free conference bridge.

9

10 One solution would be to provision all new media gateways
11 with suitable hardware and/or software for tandem-free
12 bridge compatibility in order to cover the eventuality of
13 the media gateway participating in a conference call
14 through a tandem-free bridge. However, this solution does
15 not take into consideration the large number of media
16 gateways that have already been deployed without the
17 ability to generate or process auxiliary information. For
18 these media gateways, an upgrade would now be required to
19 render them compatible with a tandem-free conference
20 bridge. This solution is both costly and inefficient.
21 Moreover, some outdated equipment may not even be amenable
22 to upgrades.

23

24 Against this background, it is clear that there is a need
25 in the industry for an improved solution to allow media
26 gateways to participate in a conference with a conference
27 bridge that operates on compressed speech in a tandem-free
28 mode, such that conferencing services can be introduced
29 gradually and without a wholesale upgrade of deployed
30 gateways.

31

32 **SUMMARY OF THE INVENTION**

33

1 A first broad aspect of the present invention seeks to
2 provide a method of processing data carried on a media path
3 between a first network element and a second network
4 element. The method comprises receiving a stream of
5 composite packets from the first network element, each
6 composite packet carrying media information and auxiliary
7 information pertaining to the composite packet. The method
8 further comprises generating, on a basis of the media
9 information and the auxiliary information carried in the
10 composite packets, an output media stream free of the
11 auxiliary information carried in the composite packets.
12 The method also comprises releasing the output media stream
13 towards the second network element.

14
15 A second broad aspect of the present invention seeks to
16 provide an apparatus for processing data carried on a media
17 path between a first network element and a second network
18 element. The apparatus comprises means for receiving a
19 stream of composite packets from the first network element,
20 each composite packet carrying media information and
21 auxiliary information pertaining to the composite packet.
22 The apparatus also comprises means for generating, on a
23 basis of the media information and the auxiliary
24 information carried in the composite packets, an output
25 media stream free of the auxiliary information carried in
26 the composite packets. The apparatus further comprises
27 means for releasing the output media stream towards the
28 second network element.

29
30 A third broad aspect of the present invention seeks to
31 provide an apparatus for processing data carried on a media
32 path between a first network element and a second network
33 element. The apparatus comprises a data interface

1 operative to receive a stream of composite packets from the
2 first network element and to release an output media stream
3 towards the second network element, each composite packet
4 carrying media information and auxiliary information
5 pertaining to the composite packet. The apparatus further
6 comprises a processing entity operative to generate, on a
7 basis of the media information and the auxiliary
8 information carried in the composite packets, the output
9 media stream free of the auxiliary information carried in
10 the composite packets.

11

12 A fourth broad aspect of the present invention seeks to
13 provide a computer program product for use with a
14 conference bridge adapter located in a media path between a
15 first data element and a second data element, the computer
16 program product comprising a computer usable medium having
17 computer readable program code thereon. The computer
18 readable program code includes program code for receiving a
19 stream of composite packets from the first network element,
20 each composite packet carrying media information and
21 auxiliary information pertaining to the composite packet.
22 The computer readable program code also includes program
23 code for generating, on a basis of the media information
24 and the auxiliary information carried in the composite
25 packets, an output media stream free of the auxiliary
26 information carried in the composite packets. The computer
27 readable program code further includes program code for
28 releasing the output media stream towards the second
29 network element.

30

31 A fifth broad aspect of the present invention seeks to
32 provide a method of processing data carried on a media path
33 between a first network element and a second network

1 element. The method comprises receiving a stream of
2 packets from the first network element, each received
3 packet carrying media information, deriving from the media
4 information carried in each received packet auxiliary
5 information pertaining to the received packet, generating a
6 stream of composite packets, each said composite packet
7 being produced from the media information carried in a
8 respective received packet and the auxiliary information
9 pertaining to the respective received packet and releasing
10 the stream of composite packets towards the second network
11 element.

12

13 A sixth broad aspect of the present invention seeks to
14 provide an apparatus for processing data carried on a media
15 path between a first network element and a second network
16 element. The apparatus comprises means for receiving a
17 stream of packets from the first network element, each
18 received packet carrying media information, means for
19 deriving from the media information carried in each
20 received packet auxiliary information pertaining to the
21 received packet, means for generating a stream of composite
22 packets, each said composite packet being produced from the
23 media information carried in a respective received packet
24 and the auxiliary information pertaining to the respective
25 received packet and means for releasing the stream of
26 composite packets towards the second network element.

27

28 A seventh broad aspect of the present invention seeks to
29 provide an apparatus for processing data carried on a media
30 path between a first network element and a second network
31 element. The apparatus comprises a data interface
32 operative to receive a stream of packets from the first
33 network element and to release a stream of composite

1 packets towards the second network element, each received
2 packet carrying media information, a processing entity
3 operative to derive from the media information carried in
4 each received packet auxiliary information pertaining to
5 the received packet, and a combiner operative to produce
6 each composite packet by combining the media information
7 carried in a respective received packet and the auxiliary
8 information pertaining to the respective received packet.

9
10 An eighth broad aspect of the present invention seeks to
11 provide a computer program product for use with a
12 conference bridge adapter located in a media path between a
13 first data element and a second data element, the computer
14 program product comprising a computer usable medium having
15 computer readable program code thereon. The computer
16 readable program code includes program code for receiving a
17 stream of packets from the first network element, each
18 received packet carrying media information, program code
19 for deriving from the media information carried in each
20 received packet auxiliary information pertaining to the
21 received packet, program code for generating a stream of
22 composite packets, each said composite packet being
23 produced from the media information carried in a respective
24 received packet and the auxiliary information pertaining to
25 the respective received packet and program code for
26 releasing the stream of composite packets towards the
27 second network element.

28.

29 A ninth broad aspect of the present invention seeks to
30 provide a method of establishing a media conference linking
31 a plurality of endpoints via a conference bridge adapted to
32 exchange composite packets carrying media information in
33 conjunction with auxiliary information pertaining to the

1 media information. The method comprises (a) determining
2 whether one or more of the endpoints is characterized by an
3 inability to exchange composite packets with the conference
4 bridge and (b) for at least one endpoint identified at a),
5 routing the media path from said endpoint via an adapter
6 that is capable of exchanging composite packets with the
7 conference bridge.

8
9 A tenth broad aspect of the present invention seeks to
10 provide a teleconferencing network. The network comprises
11 a conference bridge operative to communicate composite
12 packets carrying media information in conjunction with
13 auxiliary information pertaining to the media information,
14 a plurality of conference endpoints, at least one of which
15 is characterized by an inability to exchange the composite
16 packets with the conference bridge and a bridge adapter
17 located between the conference bridge and at least one
18 endpoint characterized by an inability to exchange
19 composite packets with the conference bridge, the adapter
20 being operative to exchange composite packets with the
21 conference bridge.

22
23 The invention may be embodied in a processor readable
24 medium containing a software program comprising
25 instructions for a processor to implement any of the above
26 described methods.

27
28 It should be appreciated that the word "packet" as used
29 herein should be construed broadly as encompassing any
30 datagram format, including but not limited to Internet
31 Protocol (IP), Asynchronous Transfer Mode (ATM), Ethernet,
32 Frame Relay, etc.

33

1 These and other aspects and features of the present
2 invention will now become apparent to those of ordinary
3 skill in the art upon review of the following description
4 of specific embodiments of the invention in conjunction
5 with the accompanying drawings.

6

7 BRIEF DESCRIPTION OF THE DRAWINGS

8

9 In the accompanying drawings:

10

11 Fig. 1 is a block diagram showing a tandem-free conference
12 bridge and a bridge adapter involved in a three-way
13 teleconference;

14

15 Fig. 2 is a block diagram showing a plurality of IP phones
16 involved in a teleconference;

17

18 Figs. 3A to 3C are schematic block diagrams of the bridge
19 adapter in accordance with embodiments of the present
20 invention.

21

22 DETAILED DESCRIPTION OF THE EMBODIMENTS

23

24 Fig. 1 shows a communications architecture in which a
25 plurality of end user devices 12, 14, 16 are desirous of
26 participating in a teleconference across a network 10.
27 Examples of end user devices 12, 14, 16 are telephony
28 devices such as telephones. The end user devices 12, 14,
29 16 communicate with respective media gateways 22, 24, 26
30 via wireless or wireline links. The media gateways 22, 24,
31 26 are connected to one another via links and nodes of the
32 network 10.

33

1 The network 10 also includes a tandem-free conference
2 bridge 30 that is capable of establishing an N -way
3 conference (in the present non-limiting specific example, N
4 = 3) on the basis of N received data streams. In such an
5 arrangement, each received data stream comprises packets
6 that carry compressed speech for a given time interval.
7 Each packet in the received data stream also comprises
8 auxiliary information, which may include one or more of:
9 signal level information for the corresponding time
10 interval, speech segment classification information (e.g.,
11 onset, sustained, offset, pause, and silence-
12 identification), signal segment descriptors, signal power,
13 a codec type, a speaker tag (identity of conference
14 participant) or any other data element characterising the
15 media information from which the compressed speech was
16 derived.

17

18 Generally speaking, one purpose of a tandem-free conference
19 bridge, such as tandem-free bridge 30, is to perform
20 speaker selection, i.e., to select M from amongst the the N
21 streams to deliver to each of the conference participants.
22 The M selected streams are said to belong to "active"
23 speakers. Typically, M is set to 2 or 3, depending on
24 factors such as the desired level of transparency of the
25 speaker selection, per link bandwidth, signal-to-noise
26 considerations, endpoint processing power and so on.
27 Speaker selection is performed on the basis of the
28 auxiliary information. For example, since the bridge has
29 knowledge of the signal power of each media stream, it can
30 make a voice activity detector (VAD) decision and/or rank
31 speakers based on how loudly they are talking. For more
32 information regarding the manner in which speaker selection
33 may be performed, the reader is referred to published

1 United States Patent Application Serial No. 09/986,498 to
2 Rabipour et al., filed on November 9, 2001, and the
3 references referred to therein, the contents of which are
4 incorporated by reference herein.

5
6 The compressed speech from the M selected streams is
7 forwarded towards each participant's media gateway. In
8 addition, some or all of the auxiliary information
9 pertaining to the compressed speech is also forwarded
10 towards each participant's media gateway. For instance,
11 the auxiliary information forwarded to the media gateway
12 may include the speaker tag and/or codec type. The speaker
13 tag can be used by the media gateway to maintain a separate
14 synthesis stream, while the codec type can be useful to
15 select the most appropriate vocoder in cases where several
16 codecs are used concurrently (e.g. wideband and
17 narrowband).

18
19 Thus, it will be appreciated that a full speech decoding
20 process is not required at a tandem-free conference bridge
21 since the information needed to carry out decisions is
22 explicitly carried in each media stream by virtue of the
23 auxiliary information. In this way, tandem speech decoding
24 and re-encoding is avoided at the conference bridge, hence
25 the term "tandem-free conference bridge". The avoidance of
26 tandem encoding and decoding operations in the network
27 tends to improve the perceived quality of the synthesized
28 speech.

29
30 Returning now to Fig. 1, media gateways 22, 24 are
31 connected to the tandem-free conference bridge 30 by
32 respective media paths 32, 34. For the purposes of the
33 example being described here in relation to Fig. 1, media

1 gateways 22, 24 are assumed to be "compatible" with the
2 tandem-free conference bridge 30. That is to say, in one
3 direction of communication, each of the media gateways 22,
4 24 is adapted to provide the tandem-free conference bridge
5 30 with "composite" packets. Each of the composite packets
6 carries compressed speech representative of speech
7 originated by the respective end user device 12, 14 in a
8 given time interval. Each of the composite packets also
9 carries auxiliary information pertaining to the compressed
10 speech carried in the composite packet.

11

12 In the opposite direction of communication, each of the
13 media gateways 22, 24 is adapted to synthesize a speech
14 signal for the respective end user device 12, 14, based on
15 M streams of composite packets received from the tandem-
16 free conference bridge 30. Each such composite packet
17 carries compressed speech for a given time interval and
18 auxiliary information pertaining to the compressed speech
19 carried in the packet. Since M selected streams are
20 received from the tandem-free conference bridge 30, there
21 will be up to M compressed speech packets received by each
22 of the media gateways 22, 24 for each time interval,
23 corresponding to the M active speakers.

24

25 For its part, media gateway 26 is connected to the tandem-
26 free conference bridge 30 by a media path 36. For the
27 purposes of the example being described here in relation to
28 Fig. 1, media gateway 26 is assumed to be incompatible with
29 the tandem-free conference bridge 30. That is to say, in
30 one direction of communication, media gateway 26 produces
31 packets containing compressed speech or uncompressed speech
32 (i.e., waveform data) representative of speech originated
33 by the end user device 16, without any auxiliary

1 information, for transmission into the network 10. In the
2 opposite direction of communication, media gateway 26
3 expects to receive packets containing compressed speech or
4 uncompressed speech (i.e., waveform data) from at most one
5 speaker at a time, for synthesis and transmission to the
6 end user device 16. The media gateway 26 is characterized
7 by an inability to process auxiliary information that forms
8 part of the composite packets sent by the tandem-free
9 conference bridge 30.

10

11 In order to allow the tandem-free conference bridge 30 to
12 nevertheless serve as a bridge for a teleconference
13 involving media gateways 22, 24 and 26 (i.e., including
14 both compatible and incompatible media gateways), the
15 network 10 comprises a bridge adapter 32 (hereinafter
16 simply referred to as "adapter" 32) through which the media
17 path 36 between the media gateway 26 and the tandem-free
18 conference bridge 30 is routed. The routing of the media
19 path 36 through the adapter 32 can be achieved during call
20 setup, for example.

21

22 A first embodiment of the adapter 32 is shown in Fig. 3A,
23 wherein there is only a single active speaker (i.e., $M =$
24 1). The adapter 32 is seen to comprise a data interface
25 42A for exchanging data with the tandem-free conference
26 bridge 30 and a data interface 42B for exchanging data with
27 the media gateway 26. Specifically, the data received from
28 the tandem-free conference bridge 30 comprises composite
29 packets 402 containing compressed speech and auxiliary
30 information pertaining to the compressed speech in each of
31 the composite packets 402. In the present example, the
32 auxiliary information includes a speaker tag indicative of
33 a selected speaker, in this case "12" being indicative of

1 end user device 12. As mentioned before, the auxiliary
2 information may include different information instead of,
3 or in addition to, the speaker tag. The data interface 42A
4 forwards the composite packets 402 to a processing entity
5 74. The processing entity 74 is adapted to remove the
6 auxiliary information from the composite packets 402 and
7 process it if necessary. In the present example, there is
8 only one active speaker, and therefore the function of the
9 processing entity 74 may be as simple as the mere removal
10 of the auxiliary information, resulting in compressed
11 speech packets 404 being fed to the data interface 42B.
12 The data interface 42B accordingly provides the compressed
13 speech packets 404 to the media gateway 26.

14
15 In the reverse direction of communication, the data
16 received from the media gateway 26 at the data interface
17 42B comprises compressed speech packets 452. The data
18 interface 42B forwards the compressed speech packets 452 to
19 a decoder 82, which converts the compressed speech packets
20 into uncompressed speech packets 454 (i.e., waveform data
21 such as PCM samples). The uncompressed speech packets 454
22 are fed to an auxiliary information extractor 84
23 (hereinafter referred to simply as "extractor 84"), which
24 processes the uncompressed speech packets 454 to extract
25 auxiliary information 456 therefrom. The extracted
26 auxiliary information can be referred to as auxiliary
27 information. In the present example, the auxiliary
28 information 456 includes a signal power, which can be
29 measured from the uncompressed speech packets 454 by a
30 signal power measurement unit forming part of the extractor
31 84. The auxiliary information 456 may also include a
32 speaker tag, which identifies the end user device 16 from
33 which the speech in the uncompressed speech packets 454

1 originated. This may be obtained on the basis of a source
2 address of the compressed speech packets 452. The
3 extractor 84 provides the auxiliary information 456 to a
4 combiner 86, which also receives the compressed speech
5 packets 452 from the data interface 42B. The combiner 82
6 associates (e.g., appends, concatenates, etc.) the
7 auxiliary information 456 to the compressed speech packets
8 452 to create composite packets 458 that are fed to the
9 data interface 42A. The data interface 42A accordingly
10 forwards the composite speech packets 458 to the tandem-
11 free conference bridge 30.

12
13 A second embodiment of the adapter 32 is shown in Fig. 3B,
14 wherein there are two active speakers (i.e., $M = 2$). The
15 adapter 32 is seen to comprise a data interface 42A for
16 exchanging data with the tandem-free conference bridge 30
17 and a data interface 42B for exchanging data with the media
18 gateway 26. Specifically, the data received from the
19 tandem-free conference bridge 30 comprises composite
20 packets 402 containing compressed speech and auxiliary
21 information pertaining to the compressed speech in each of
22 the composite packets 402. In the present example, the
23 auxiliary information includes a speaker tag indicative of
24 a selected speaker, either "12" being indicative of end
25 user device 12 or "14" being indicative of end user device
26 14. As mentioned before, the auxiliary information may
27 include different information instead of, or in addition
28 to, the speaker tag. The data interface 42A forwards the
29 composite packets 402 to a processing entity 74.

30

31 The processing entity 74 is adapted to remove the auxiliary
32 information from the composite packets 402 and process it
33 if necessary. In the present example, there are two active

1 speakers, and therefore the function of the processing
2 entity 74 may be as simple as the sorting of the composite
3 packets 402 into one of two streams of compressed speech
4 packets 404A, 404B, based on the speaker identified in the
5 auxiliary information. In another embodiment, the
6 processing entity 74 may determine a vocoder type from the
7 auxiliary information, which may indicate that the two
8 streams of compressed speech packets 404A, 404B have been
9 compressed using different vocoder rates or algorithms, for
10 example.

11
12 The two streams of compressed speech packets 404A, 404B are
13 fed to respective decoders 76A, 76B. Decoder 76A converts
14 the speech in the respective stream of compressed speech
15 packets 404A into a stream of uncompressed speech packets
16 408A (e.g., waveform data such as PCM samples). Similarly,
17 decoder 76B converts the speech in the respective stream of
18 compressed speech packets 404B into a stream of
19 uncompressed speech packets 408B (e.g., waveform data such
20 as PCM samples). It is recalled that the processing entity
21 74 may indicate to each of the decoders 76A, 76B that it is
22 to use a different rate or algorithm, for example. The
23 uncompressed speech packets 408A, 408B are fed to a
24 combiner 78, which mixes together individual packets from
25 each stream, thereby creating a stream of resultant
26 uncompressed speech packets 410. The resultant
27 uncompressed speech packets 410 are fed to an encoder 80,
28 which re-encodes the speech, resulting in compressed speech
29 packets 406. The compressed speech packets 406 are fed to
30 the data interface 42B, which accordingly forwards the
31 speech packets 406 to the media gateway 26. In an
32 alternative embodiment, the encoder 80 produces compressed
33 speech which is packetized by the data interface 42B.

1
2 In the reverse direction of communication, essentially the
3 same operations are performed as before. Specifically, the
4 data received from the media gateway 26 at the data
5 interface 42B comprises compressed speech packets 452. The
6 data interface 42B forwards the compressed speech packets
7 452 to a decoder 82, which is adapted to produce
8 uncompressed speech packets 454 (i.e., waveform data such
9 as PCM samples). The uncompressed speech packets 454 are
10 fed to an extractor 84, which processes the uncompressed
11 speech packets 454 to extract auxiliary information 456
12 therefrom. The extracted auxiliary information can be
13 referred to as auxiliary information. In the present
14 example, the auxiliary information 456 includes a signal
15 power, which can be measured from the uncompressed speech
16 packets 454 by a signal power measurement unit forming part
17 of the extractor 84. The auxiliary information 456 may
18 also include a speaker tag, which identifies the end user
19 device 16 from which the speech in the uncompressed speech
20 packets 454 originated. This may be obtained on the basis
21 of a source address of the compressed speech packets 452.
22 The extractor 84 provides the auxiliary information 456 to
23 a combiner 86, which also receives the compressed speech
24 packets 452 from the data interface 42B. The combiner 82
25 combines (e.g., appends, concatenates, etc.) the auxiliary
26 information 456 to the compressed speech packets 452 to
27 create composite packets 458 that are fed to the data
28 interface 42A. The data interface 42A accordingly forwards
29 the composite speech packets 458 to the tandem-free
30 conference bridge 30.
31
32 Those skilled in the art will of course appreciate that the
33 concepts described herein above can be extended to

1 situations when there are more than two active speakers.
2 Also, the above description has assumed that each of the
3 gateways 22, 24, 26 is adapted to receive speech from an
4 end user device in PCM format and encode the speech into
5 vocoder-compressed speech parameters. The typical reason
6 for such encoding is to drastically reduce the bandwidth
7 required to transmit human speech by representing the
8 speech in terms of parametric data rather than waveform
9 data. However, this need not be the case. In fact,
10 embodiments of the invention are contemplated in which the
11 gateways 22, 24, 26 are accustomed to sending and receiving
12 uncompressed speech (i.e., waveform data such as PCM
13 samples).

14
15 Accordingly, a third embodiment of the adapter 32 is shown
16 in Fig. 3C, wherein there are again two active speakers
17 (i.e., $M = 2$). However, in this case, the media gateway
18 exchanges speech in uncompressed form (e.g., PCM samples).
19 The adapter 32 is seen to comprise a data interface 42A for
20 exchanging data with the tandem-free conference bridge 30
21 and a data interface 42B for exchanging data with the media
22 gateway 26. Specifically, the data received from the
23 tandem-free conference bridge 30 comprises composite
24 packets 402 containing compressed speech and auxiliary
25 information pertaining to the compressed speech in each of
26 the composite packets 402. In the present example, the
27 auxiliary information includes a speaker tag indicative of
28 a selected speaker, either "12" being indicative of end
29 user device 12 or "14" being indicative of end user device
30 14. As mentioned before, the auxiliary information may
31 include different information instead of, or in addition
32 to, the speaker tag. The data interface 42A forwards the
33 composite packets 402 to a processing entity 74.

1

2 The processing entity 74 is adapted to remove the auxiliary
3 information from the composite packets 402 and process it
4 if necessary. In the present example, there are two active
5 speakers, and therefore the function of the processing
6 entity 74 may be as simple as the sorting of the composite
7 packets 402 into one of two streams of compressed speech
8 packets 404A, 404B, based on the speaker identified in the
9 auxiliary information. In another embodiment, the
10 processing entity 74 may determine a vocoder type from the
11 auxiliary information, which may indicate that the two
12 streams of compressed speech packets 404A, 404B have been
13 compressed using different vocoder rates or algorithms, for
14 example.

15

16 The two streams of compressed speech packets 404A, 404B are
17 fed to respective decoders 76A, 76B. Decoder 76A converts
18 the speech in the respective stream of compressed speech
19 packets 404A into a stream of uncompressed speech packets
20 408A (e.g., waveform data such as PCM samples). Similarly,
21 decoder 76B converts the speech in the respective stream of
22 compressed speech packets 404B into a stream of
23 uncompressed speech packets 408B (e.g., waveform data such
24 as PCM samples). It is recalled that the processing entity
25 74 may indicate to each of the decoders 76A, 76B that it is
26 to use a different rate or algorithm, for example. The
27 uncompressed speech packets 408A, 408B are fed to a
28 combiner 78, which mixes together individual packets from
29 each stream, thereby creating a stream of resultant
30 uncompressed speech packets 410. The resultant
31 uncompressed speech packets 410 are fed to the data
32 interface 42B, which accordingly forwards the speech
33 packets 406 to the media gateway 26.

1
2 In the reverse direction of communication, the data
3 received from the media gateway 26 at the data interface
4 42B comprises uncompressed speech packets 454. The data
5 interface 42B forwards the uncompressed speech packets 454
6 to both an encoder 88 and an extractor 84. The encoder
7 encodes the uncompressed speech packets, resulting in
8 compressed speech packets 452, which is fed to a combiner
9 86. The extractor processes the uncompressed speech
10 packets 454 to extract auxiliary information 456 therefrom.
11 The extracted auxiliary information can be referred to as
12 auxiliary information. In the present example, the
13 auxiliary information 456 includes a signal power, which
14 can be measured from the uncompressed speech packets 454 by
15 a signal power measurement unit forming part of the
16 extractor 84. The auxiliary information 456 may also
17 include a speaker tag, which identifies the end user device
18 16 from which the speech in the uncompressed speech packets
19 454 originated. This may be obtained on the basis of a
20 source address of the uncompressed speech packets 454. The
21 extractor 84 provides the auxiliary information 456 to the
22 combiner 86. The combiner 82 associates (e.g., appends,
23 concatenates, etc.) the auxiliary information 456 to the
24 compressed speech packets 452 to create composite packets
25 458 that are fed to the data interface 42A. The data
26 interface 42A accordingly forwards the composite speech
27 packets 458 to the tandem-free conference bridge 30.

28

29 One way of setting up a teleconference using the tandem-
30 free conference bridge 30 and the adapter 32 is now
31 described with reference again to Fig. 1. From a control
32 plane perspective, the media gateways 22, 24, 26, the
33 tandem-free conference bridge 30 and the adapter 32 are

1 controlled by network elements 52, 54, 56 that act as media
2 gateway controllers. In this specific example, media
3 gateway controller 52 has control over media gateway 22,
4 media gateway controller 54 has control over media gateway
5 54 and the tandem-free conference bridge 30, and media
6 gateway controller 56 has control over media gateway 26 and
7 the adapter 32.

8
9 To establish the conference, the media gateway controllers
10 52, 54, 56 communicate with each other using a signalling
11 protocol. Signalling between media gateway controllers 52
12 and 54 will reveal that these media gateways are both
13 compatible with the tandem-free conference bridge 30.
14 Thus, media gateway controller 52 establishes media path 32
15 between media gateway 22 and the tandem-free conference
16 bridge 30, while media gateway controller 54 establishes
17 media path 34 between media gateway 24 and the tandem-free
18 conference bridge 30.

19
20 However, signalling between media gateway controller 56 and
21 either media gateway controller 52 or media gateway
22 controller 54 will reveal that media gateway 26 is not
23 compatible with the tandem-free conference bridge 30.
24 Thus, media gateway controller 56 causes media path 36 to
25 pass through adapter 32 between media gateway 26 and the
26 tandem-free conference bridge 30. In addition, the media
27 gateway controller 56 activates the appropriate
28 functionality / configuration of the adapter 32, e.g., the
29 functionality of the processing entity 74, the number of
30 decoders 76A, 76B, the presence / absence of the decoder
31 82, encoder 88 and encoder 80, the presence / absence of
32 the combiner 80, etc.

33

1 It will be apparent that the routing of media path 36
2 through the adapter 32 allows end user device 16 to
3 participate in a conference with end user devices 12, 14
4 via the tandem-free conference bridge 30. Hence, the
5 provision of the adapter 32 eliminates the need to retrofit
6 existing media gateways with the ability to interface with
7 newly available tandem-free conference bridges. Advantages
8 also arise in those instances where it may not be possible
9 to implement tandem-free conferencing until standards have
10 been defined; in absence of such standards, the adapter 32
11 would allow the implementation of tandem-free conferencing
12 to work with standard existing devices.

13

14 It should also be understood that the present invention
15 imposes no limitation on the number of participants in the
16 conference of interest, nor on the number of active
17 speakers, nor on whether a particular media gateway that
18 participates in the conference is compatible or
19 incompatible with the tandem-free conference bridge 30. In
20 the present case, the selection of media gateway 26 as
21 being incompatible with the tandem-free conference bridge
22 30 has been made completely arbitrarily and by way of
23 illustration only.

24

25 It is envisaged that in the scenario where the majority of
26 the media gateways in the network 10 would be incompatible
27 with the tandem-free conference bridge 30, a bank of
28 adapters 32 may be made available in the network 10 so as
29 to be used by conferees when required. For example,
30 consider the scenario depicted in Fig. 2, where four "IP
31 phones" 202, 204, 206, 208 are desirous of participating in
32 a telephone conference. Each of the IP phones 202, 204,
33 206, 208 comprises the functionality of a telephone as well

1 as a vocoder to exchange compressed speech with the network
2 10. In this sense, packet-based speech and possibly video
3 is transmitted towards the conference bridge 30. However,
4 the IP phones are not aware that the conference bridge 30
5 is a tandem-free conference bridge that exchanges composite
6 packets, each composite packet carrying media information
7 in conjunction with auxiliary information pertaining to the
8 media information. It is therefore envisaged that a
9 plurality of adapters 232, 234, 236, 238 would be located
10 in the media paths between the respective IP phones 202,
11 204, 206, 208 and the tandem-free bridge 30, until such
12 time as IP phones are upgraded to support interaction with
13 tandem-free conference bridges.

14
15 Those skilled in the art will also appreciate that the
16 present invention can also be applied to videoconferencing
17 where there is provided a bridge that performs video stream
18 selection on the basis of auxiliary information pertaining
19 to packets in each of a plurality of compressed video
20 streams. Therefore, the present invention is not limited
21 to packets of compressed and uncompressed speech, but
22 rather is applicable additionally to packets of compressed
23 and uncompressed video and, more generally, to packets of
24 compressed and uncompressed "media", where media includes
25 but is not limited to one or more of speech, audio, still
26 imagery and video.

27
28 It should also be understood that the word "packet" as used
29 herein should be construed broadly as encompassing any
30 datagram format, including but not limited to Internet
31 Protocol (IP), Asynchronous Transfer Mode (ATM), Ethernet,
32 Frame Relay, etc.

33

1 Those skilled in the art will appreciate that in some
2 embodiments, the functionality of the adapter 32 (e.g.,
3 processing entity 74, decoders 76A, 76B, combiner 78,
4 encoder 80, decoder 82, extractor 84, combiner 86, encoder
5 88) may be implemented as pre-programmed hardware or
6 firmware elements (e.g., application specific integrated
7 circuits (ASICs), electrically erasable programmable read-
8 only memories (EEPROMs), etc.), or other related
9 components. In other embodiments, the adapter 32 may be
10 implemented as an arithmetic and logic unit (ALU) having
11 access to a code memory (not shown) which stores program
12 instructions for the operation of the ALU. The program
13 instructions could be stored on a medium which is fixed,
14 tangible and readable directly by the adapter 32, (e.g.,
15 removable diskette, CD-ROM, ROM, or fixed disk), or the
16 program instructions could be stored remotely but
17 transmittable to the adapter 32 via a modem or other
18 interface device (e.g., a communications adapter) connected
19 to a network over a transmission medium. The transmission
20 medium may be either a tangible medium (e.g., optical or
21 analog communications lines) or a medium implemented using
22 wireless techniques (e.g., microwave, infrared or other
23 transmission schemes).

24

25 While specific embodiments of the present invention have
26 been described and illustrated, it will be apparent to
27 those skilled in the art that numerous modifications and
28 variations can be made without departing from the scope of
29 the invention as defined in the appended claims.

30